

Which Matters More in Long-Segment Posterior Fusion Involving the Cervicothoracic Junction: Extension From C7 to the Thoracic Spine or from C3 to C2?

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Introduction

Long-segment posterior spinal fusion involving the cervicothoracic junction carries higher complication rates due to its unique anatomy and biomechanical stress as compared with non-junctional regions. To address this issue, the extension of fusions from C7 to the thoracic spine and/or C3 to C2 is oftentimes performed. However, the impact of the caudal extension in conjunction with the rostral extension on clinical outcomes has not yet been well-characterized in the literature.

Methods

Retrospective clinical record review from 2010 to 2015 identified 157 patients undergoing long-segment posterior cervical or cervicothoracic fusion (C3-C7, C3-T2, C2-C7, or C2-T2) for degenerative diseases with a minimum one-year follow-up period. They were sub-classified into the two groups: fusions ending in the cervical spine (Group 1, n=58) and those ending in the thoracic spine (Group 2, n=99). Rates of pseudarthrosis, adjacent segment disease, and overall surgical revision were compared as primary outcome measures. P values < 0.05 were defined as statistically significant.

Results

There were no statistically significant differences in baseline characteristics such as age, BMI, and gender. Group 2 had significantly higher estimated blood loss and longer operative time and hospital stay than those in Group 1 (p<0.05 for each). Rates of all three primary outcomes were comparable between the groups (Table 1). In multivariate analysis (Table 2), the upper-most level (C2 versus C3) was the only independent factor predictive of rates of pseudarthrosis (p=0.003), adjacent segment disease (p=0.019), and reoperation (p=0.016).

Conclusions

The rates of adverse surgical outcomes in long-segment cervical fusions were highly correlated with the upper-most level of the fusion, regardless of its corresponding caudal level extension. Given the higher estimated blood loss and longer operative time and length of hospital stay associated with the caudal extension, preferential selection of the upper-most fusion level at C2 should take precedence over routinely extending into the thoracic spine.

Table 1

	Lower-Most Segment			Upper-Most Segment		
	C7 (Group 1)	T2 (Group 2)	P Value	C2	C3	P Value
Pseudarthrosis	6.9%	3.0%	0.425	0.0%	8.1%	<u>0.017</u>
Adjacent Segment Disease	8.6%	4.0%	0.292	1.4%	9.3%	<u>0.041</u>
Overall Reoperation	24.1%	21.2%	0.695	14.1%	29.1%	<u>0.034</u>

Comparison between C7 versus T2 as the lower-most segment as well as C2 versus C3 as the upper-most segment regarding the three primary outcomes

Table 2

	P Values		
	Pseudarthrosis	Adjacent Segment Disease	Overall Reoperation
C2 versus C3	<u>0.003</u>	<u>0.019</u>	<u>0.016</u>
Age	0.17	0.11	0.14
C7 versus T2	N.S.	N.S.	N.S.

N.S.: non-significant

Multivariate analysis on factors influencing the three primary outcomes.

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the importance of the proximal extension of fusions rather than the distal extension in cervicothoracic junction surgery and 2) Discuss, in small groups, advantages and disadvantages of C7-to-thoracic extension as well as C3-to-C2 extension.